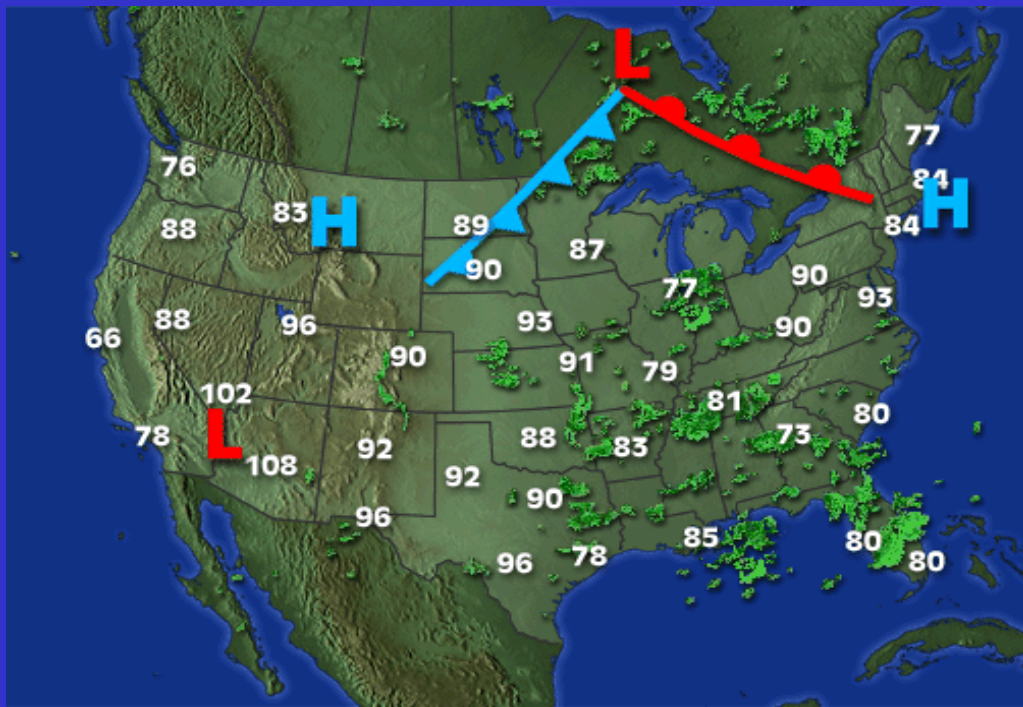


Weather 101

Fundamental Meteorology for Turf Managers

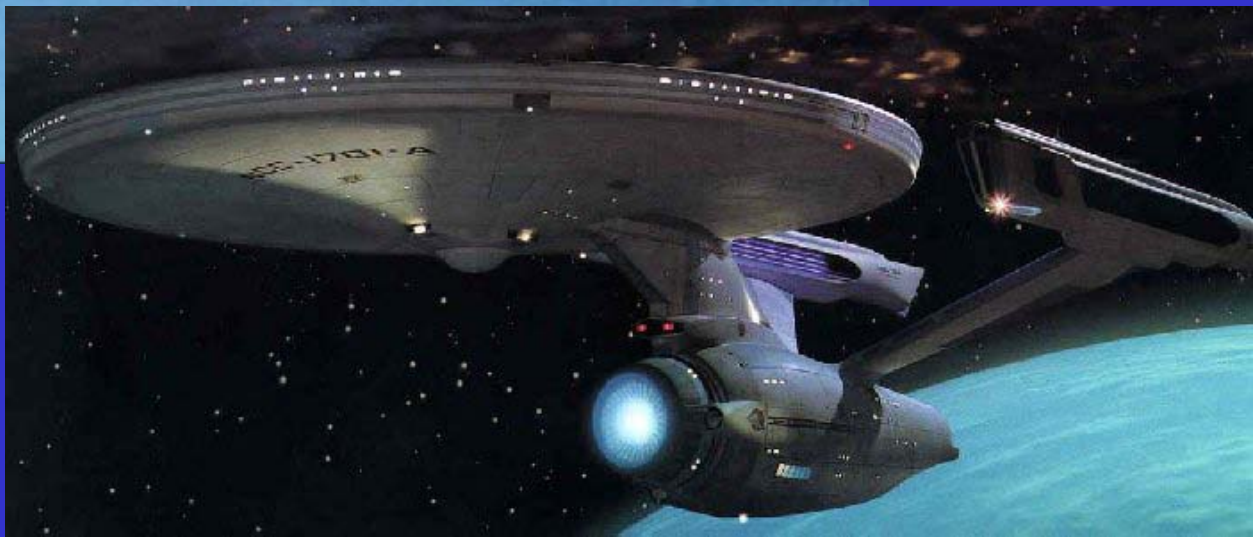


Brad Jakubowski
Doane College

SportsTurf
MANAGERS ASSOCIATION









Austin TX

Enter Your "City, ST" or zip code

Go

BOOKMARK



NWS Austin/San Antonio, TX

[Mobile Weather Information](#) | [En Español](#)

Point Forecast: Austin TX [[Similar City Names](#)]

Last Update: 9:16 pm CST Jan 4, 2011

30.27°N 97.74°W (Elev. 508 ft)

Forecast Valid: 10pm CST Jan 4, 2011-6pm CST Jan 11, 2011

Forecast at a Glance

Tonight	Wednesday	Wednesday Night	Thursday	Thursday Night	Friday	Friday Night	Saturday	Saturday Night
Areas Fog	Areas Fog	Partly Cloudy	Mostly Sunny	Partly Cloudy	Mostly Sunny	Partly Cloudy	Chance Showers	Chance Showers
Lo 53 °F	Hi 67 °F	Lo 34 °F	Hi 64 °F	Lo 33 °F	Hi 67 °F	Lo 37 °F	40% Hi 65 °F	40% Lo 46 °F

Detailed 7-day Forecast

Tonight: Areas of fog. Otherwise, cloudy, with a low around 53. Calm wind becoming west southwest around 5 mph.

Wednesday: Areas of fog before 9am. Otherwise, partly sunny, with a high near 67. Northwest wind between 5 and 15 mph.

Wednesday Night: Partly cloudy, with a low around 34. North northwest wind between 5 and 10 mph.

Thursday: Mostly sunny, with a high near 64. North wind around 5 mph becoming calm.

Thursday Night: Partly cloudy, with a low around 33. Calm

Current Conditions

[\[Move Down\]](#)

[view Yesterday's Weather](#)

Camp Mabry / Austin City

Lat: 30.32 Lon: -97.77 Elev: 621

Last Update on Jan 4, 8:51 pm CST

Fog/Mist

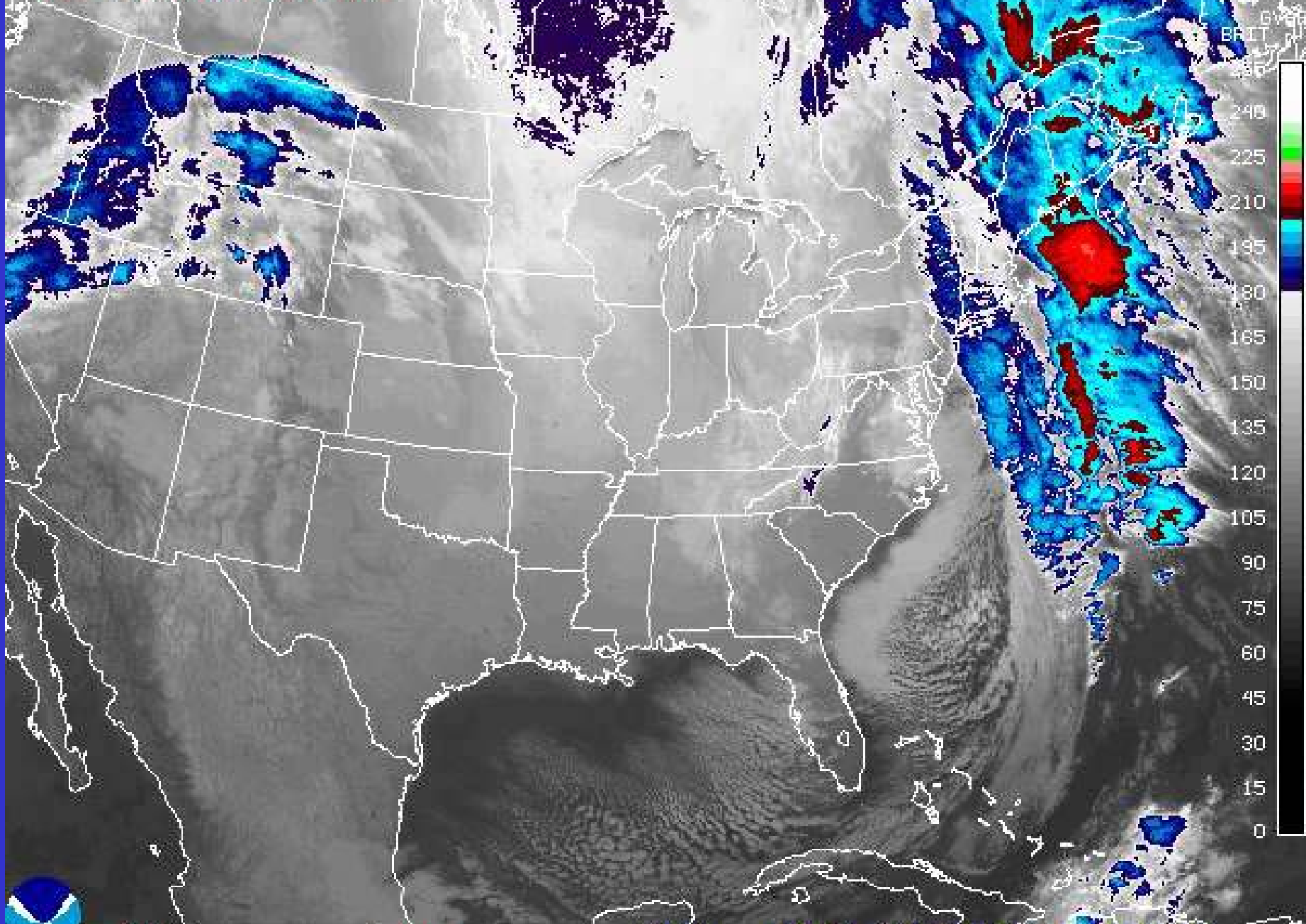
57 °F
(14 °C)

Humidity:	93 %
Wind Speed:	Calm
Barometer:	30.02" (1016.3 mb)
Dewpoint:	55 °F (13 °C)
Visibility:	4.00 mi.

[More Local Wx:](#) [3 Day History:](#)

Date	Time (cst)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (°F)				Pressure		Precipitation (in.)		
						Air	Dwpt	6 hour		altimeter (in.)	sea level (mb)	1 hr	3 hr	6 hr
								Max.	Min.					
04	19:48	Calm	2.50	Fog/Mist	OVC014	57	55			30.02	1016.6			
04	18:51	Calm	3.00	Fog/Mist	OVC016	57	55			30.01	1016.2			
04	17:51	Calm	3.00	Fog/Mist	SCT006 OVC014	57	55	58	55	30.01	1016.3			0.05
04	16:51	Calm	1.50	Fog/Mist	OVC006	57	55			30.02	1016.6			
04	15:51	Calm	1.50	Light Rain Fog/Mist	OVC006	57	55			30.02	1016.8	0.01		
04	14:51	Calm	3.00	Light Rain Fog/Mist	OVC006	57	55			30.04	1017.3		0.04	
04	13:51	N 5	1.00	Light Rain Fog/Mist	BKN006 OVC014	56	54			30.06	1017.7	0.04		
04	12:51	Calm	1.25	Rain Fog/Mist	OVC008	56	52			30.08	1018.7			
04	11:51	N 3	4.00	Overcast with Haze	OVC008	57	52	57	50	30.12	1019.9			
04	10:51	NE 3	3.00	Light Rain Fog/Mist	OVC008	55	51			30.14	1020.6			
04	09:51	Calm	6.00	Overcast with Haze	OVC008	56	50			30.14	1020.7			
04	08:51	Calm	10.00	Overcast	OVC008	55	48			30.12	1019.8			
04	07:51	Calm	10.00	Overcast	OVC010	53	46			30.10	1019.3			
04	06:51	Calm	10.00	Overcast	OVC012	51	45			30.09	1019.0			
04	05:51	Calm	10.00	Overcast	OVC016	50	45	53	48	30.08	1018.6			

12 13 2010 1415Z



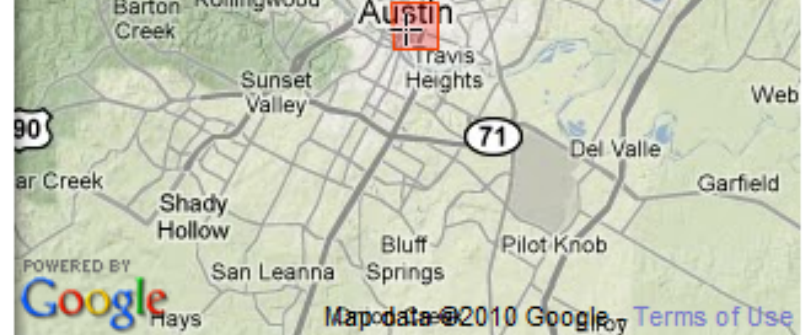
IR


8 km

NOAA

[HTTP://WWW.GOES.NOAA.GOV](http://www.goes.noaa.gov)

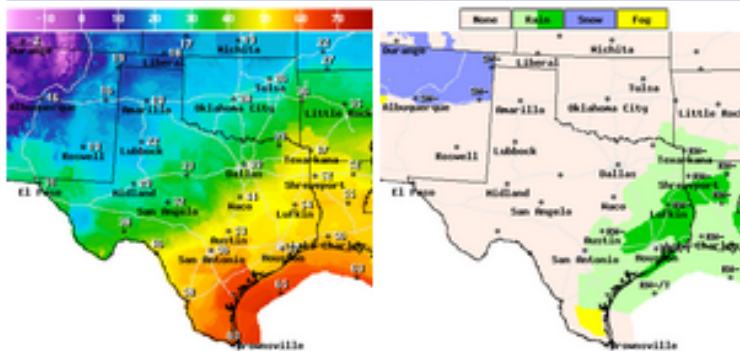
Tuesday: Sunny, with a high near 38.



Requested Location  Forecast Area
Lat/Lon: 30.27°N 97.74°W Elevation: 508 ft



National Digital Forecast Database



Additional Forecasts & Information

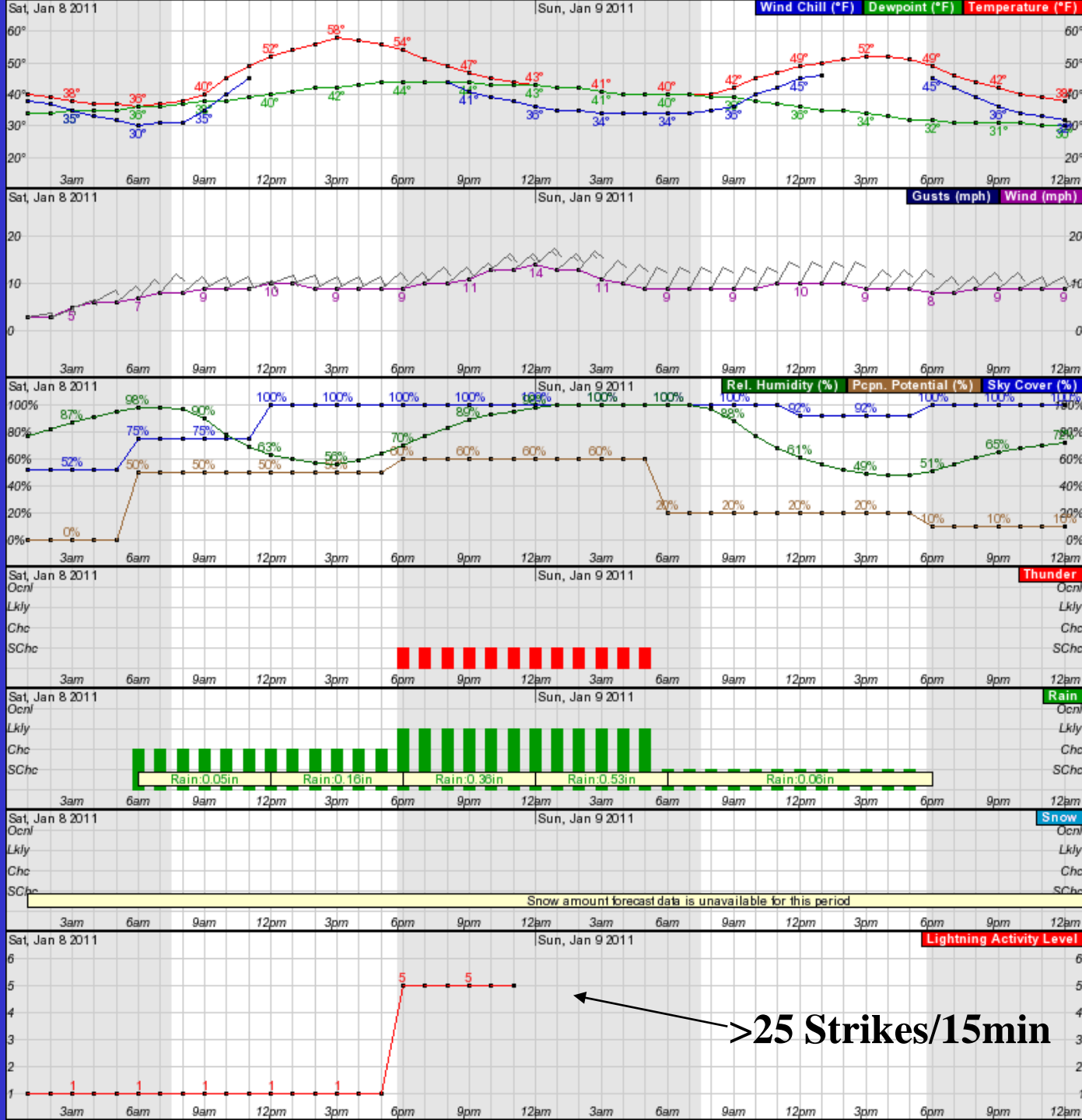
Zone Area Forecast for Travis County, TX

- [Forecast Discussion](#)
- [Printable Forecast](#)
- [Hourly Weather Graph](#)
- [Rivers and Lakes](#)
- [Air Quality Forecasts](#)
- [Text Only Forecast](#)
- [Tabular Forecast](#)
- [Quick Forecast](#)
- [International System of Units](#)
- [Local Forecasts](#)
- [Severe Weather](#)
- [Satellite Imagery](#)
- [Marine/Tropical Weather](#)
- [About Point Forecasts](#)
- [Current Weather](#)
- [Local Climatology](#)
- [NOAA Weather Radio](#)
- [Aviation Weather](#)
- [NWS Austin/San Antonio Home](#)

Webmaster
National Weather Service:
Austin/San Antonio, TX

[Back to Previous Page](#)

www.weather.gov
[Privacy Policy](#)
[Disclaimer](#)
[Credits](#)



80-100%

60-70%

30-50%

20%

>25 Strikes/15min

Weather Elements

- Temperature (°F)
- Dewpoint (°F)
- Wind Chill (°F)
- Surface Wind mph
- Sky Coverage
- Precipitation Potential
- Relative Humidity

Weather/Precipitation

- Thunder
- Rain
- Snow
- Freezing Rain
- Sleet

Fire Weather

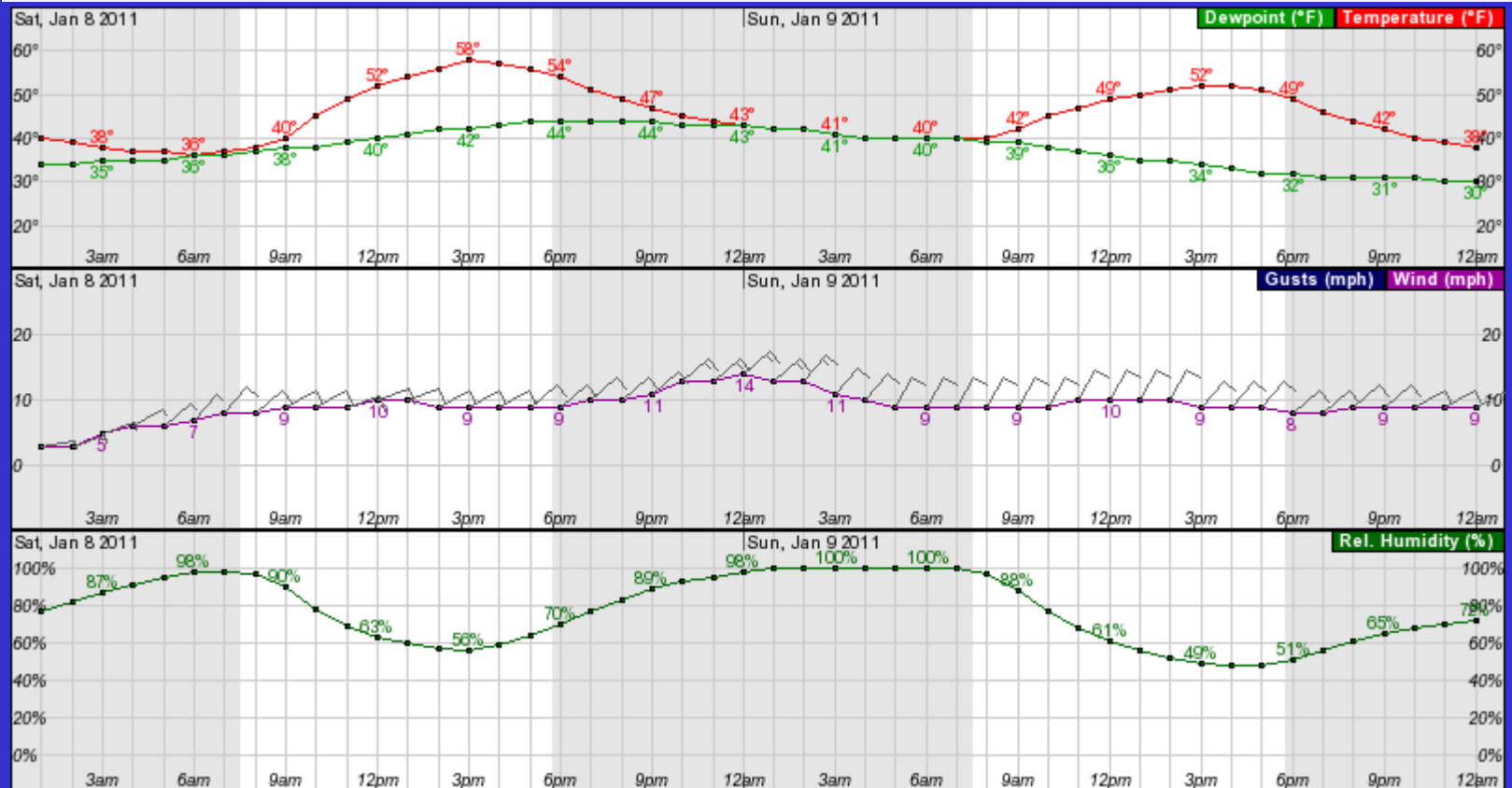
- Mixing Height (x100ft)
- Haines Index
- Lightning Activity Level
- Trans. Wind mph
- 20ft Wind mph
- Dispersion Index

48-Hour Period Starting: 1am Sat, Jan 8 2011

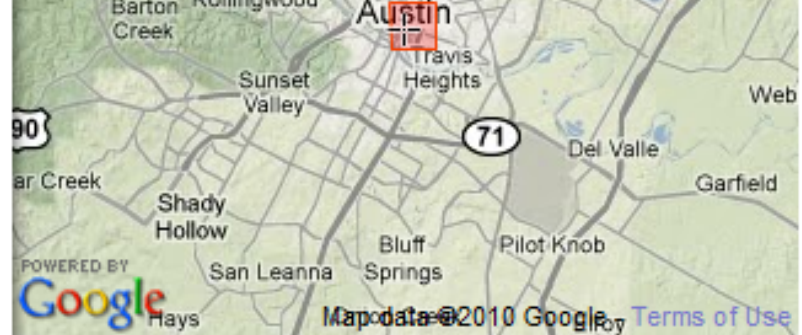
Submit


Back 2 Days

Forward 2 Days



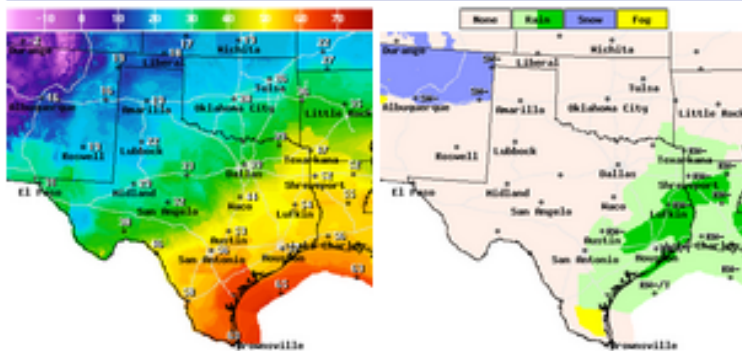
Tuesday: Sunny, with a high near 38.



Requested Location  Forecast Area
Lat/Lon: 30.27°N 97.74°W Elevation: 508 ft



National Digital Forecast Database



Additional Forecasts & Information

Zone Area Forecast for Travis County, TX

- [Forecast Discussion](#)
- [Printable Forecast](#)
- [Hourly Weather Graph](#)
- [Quick Forecast](#)
- [International System of Units](#)
- [Local Forecasts](#)
- [Severe Weather](#)
- [Satellite Imagery](#)
- [Marine/Tropical Weather](#)
- [Rivers and Lakes](#)
- [Air Quality Forecasts](#)
- [Text Only Forecast](#)
- [Tabular Forecast](#)
- [About Point Forecasts](#)
- [Current Weather](#)
- [Local Climatology](#)
- [NOAA Weather Radio](#)
- [Aviation Weather](#)
- [NWS Austin/San Antonio Home](#)

Webmaster
National Weather Service:
Austin/San Antonio, TX

[Back to Previous Page](#)

www.weather.gov
[Privacy Policy](#)
[Disclaimer](#)
[Credits](#)

Local forecast by
"City, St" or Zip Code

[XML](#) [RSS Feeds](#)

Warnings
Current
By State/County...
UV Alerts
more....

Observations
Radar
Satellite
Snow Cover
Surface Weather...
Observed Precip
more....

Forecasts
Local
Graphical
Aviation
Marine
Hurricanes
Severe Weather
Fire Weather
more....

Text Messages
By State
By Message Type
National

Forecast Models
Numerical Models
MOS Prod Statistical
Model
GFS-LAMP Prod
Statistical Model
more....

Area Forecast Discussion

Issued by NWS Austin/San Antonio, TX

Current Version | [Previous Vers](#)
Versions: [1](#) [2](#) [3](#) [4](#) [5](#) [6](#) [7](#) [8](#) [9](#) [10](#) [11](#)
[39](#) [40](#) [41](#) [42](#) [43](#) [44](#) [45](#) [46](#) [47](#) [48](#) [49](#)

000
FXUS64 KEWX 102331
AFDEWX

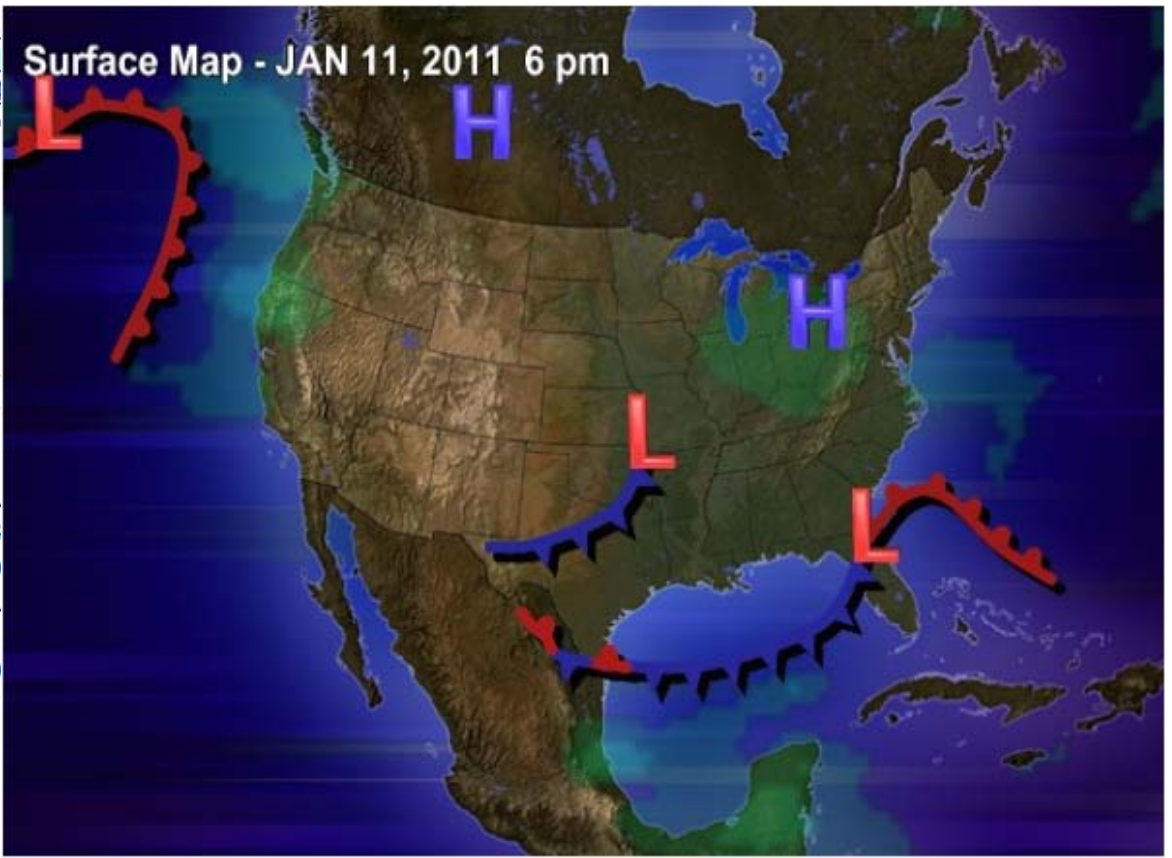
AREA FORECAST DISCUSSION
NATIONAL WEATHER SERVICE
531 PM CST MON JAN 10 2011

.AVIATION...
DIFFICULT AVIATION FORECA
BIT IN THE [IFR/LIFR](#) CATEG
OUR AREA. EXPECT CIGS AND
FOR THE NEXT SEVERAL HOUR
SOMETIME AROUND MIDNIGHT
BETWEEN 10 AND 15 [KTS](#) AND
IMPROVE RAPIDLY ONCE THE
UNTIL AROUND 12Z. EXPECT
AFTERNOON.

&&

.PREV DISCUSSION... /ISSUED 333 PM CST MON JAN 10 2011/

DISCUSSION...
SLOW [EROSION](#) OF CLOUDS FROM THE NORTHWEST SHOULD CEASE AND BE
REPLACED BY CLOUDY SKIES FROM WEAK LIFT AHEAD OF THE ADVANCING
ARCTIC [FRONT](#) NOW IN THE PANHANDLE AND OKLAHOMA. THE [FRONT](#) SHOULD
ARRIVE IN THE NORTHERN PORTIONS OF OUR AREA AROUND 09-10Z AND
AFFECT THE ENTIRE [CWA](#) BY 13Z.



Weather

It's all about...

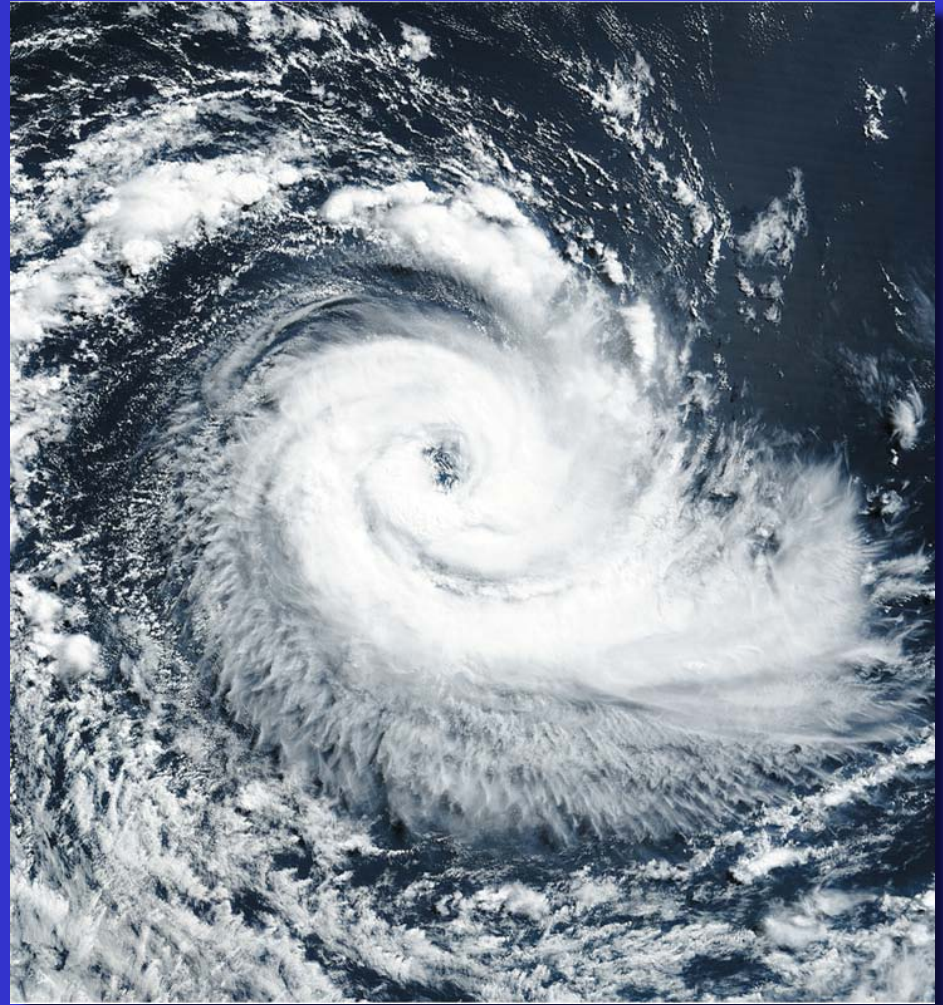
Heat

Water



Water

- One of the Earth's biggest recycling programs
 - One Gulf of Mexico Each Year
- One of the Earth's greatest power sources



Water's Changes of State



Ice melting **absorbs HEAT**

Anyone make ice cream?

1200 BTUs/gallon



Evaporation **absorbs HEAT**

Anyone syringe their turf?

8950 BTUs/gallon

Condensation RELEASES HEAT

8950 BTUs/gallon



Water's Changes of State

Freezing releases
HEAT



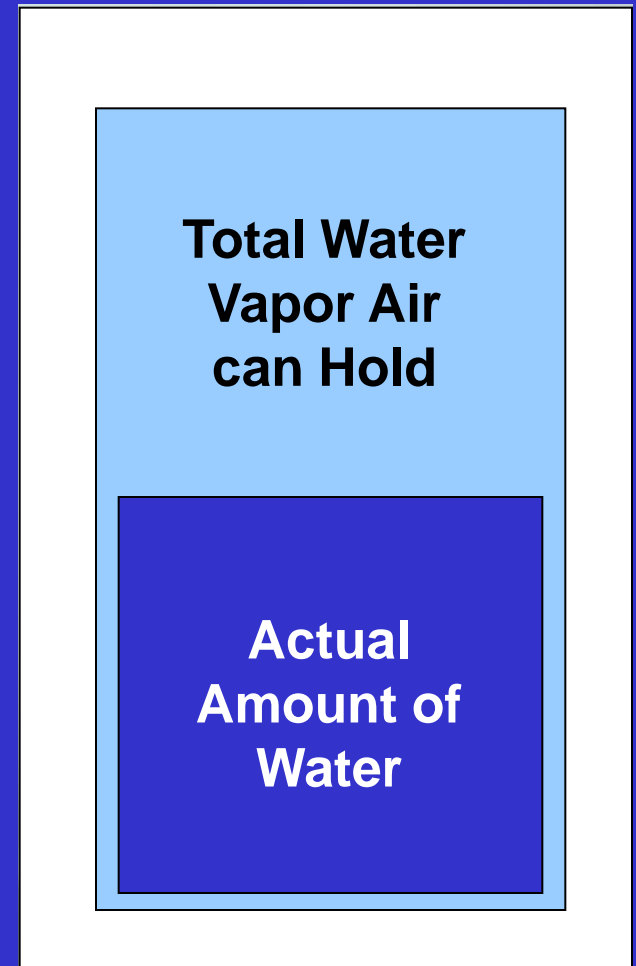
1200 BTUs/gallon

Relative Humidity: Is a Ratio

Amount of H₂O in air

How much H₂O air can hold

- Indicates how near air is to being 100% saturated with water
- NOT actual amount of water in the air



**50% Relative
Humidity**

Which location is more humid (Has more total moisture)?

Saturation Mixing Ratio (Sea Level)

Temperature (°F)	g/kg
-40	0.1
-22	0.3
0	1
14	2
32	3.5
40	4
50	7
60	11
70	16
80	20
90	32
100	45

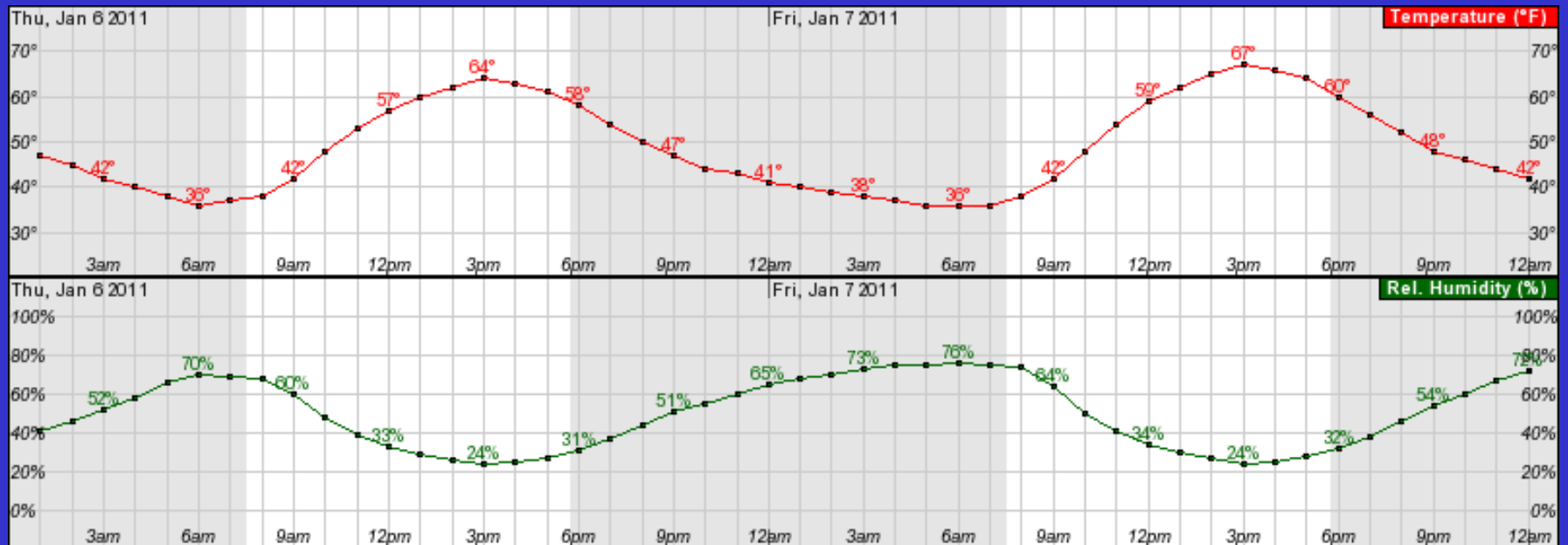
Location A



Location B



Relative Humidity changes with Temperature



Dew Point

or Dew Point Temperature

- The temperature at which condensation occurs
 - Air Temp = Dewpoint
 - Dew forms on surfaces
- **Better indicator of how moist the air is**



Dew-point temperature

$\leq 10^{\circ}\text{F}$	Significant snowfall is inhibited.
$\geq 55^{\circ}\text{F}$	Minimum for severe thunderstorms to form.
$\geq 65^{\circ}\text{F}$	Considered humid by most people.
$\geq 70^{\circ}\text{F}$	Typical of the rainy tropics.
$\geq 75^{\circ}\text{F}$	Considered oppressive by most.

So:

High dew point
temps = **moist air**

Low dew point
temps = **dry air**

Lincoln Municipal Airport

Lat: 40.86 Lon: -96.75 Elev: 1184

Last Update on Jan 4, 8:54 pm CST

Fair

20 °F
(-7 °C)

Humidity:	78 %
Wind Speed:	Calm
Barometer:	29.98" (1017.2 mb)
Dewpoint:	14 °F (-10 °C)
Visibility:	10.00 mi.

[More Local Wx:](#)

[3 Day History:](#)

Which has the most "Humid" air?

Atlanta, Fulton County Airport-Brown Field

Lat: 33.78 Lon: -84.52 Elev: 863

Last Update on Jan 4, 4:53 pm EST

Fair

56 °F
(13 °C)

Humidity:	28 %
Wind Speed:	W 7 MPH
Barometer:	30.06" (1018.1 mb)
Dewpoint:	23 °F (-5 °C)
Visibility:	10.00 mi.

More Local Wx: 3 Day History:

Phoenix, Phoenix Sky Harbor International Airport

Last Update on 04 Jan 15:51 MST

Mostly
Cloudy

58°F
(14°C)

Humidity:	37 %
Wind Speed:	WSW 7 MPH
Barometer:	30.15 in (1020.60 mb)
Dewpoint:	32°F (0°C)
Visibility:	10.00 Miles

More Local Wx: 3 Day History:

Logan, Logan-Cache Airport

Last Update on 04 Jan 15:51 MST

Fog

11°F
(-12°C)

Humidity:	84 %
Wind Speed:	SW 3 MPH
Barometer:	30.27 in (1033.40 mb)
Dewpoint:	7°F (-14°C)
Wind Chill:	6°F (-14°C)
Visibility:	5.00 Miles

More Local Wx: 3 Day History:

Greater Buffalo International Airport

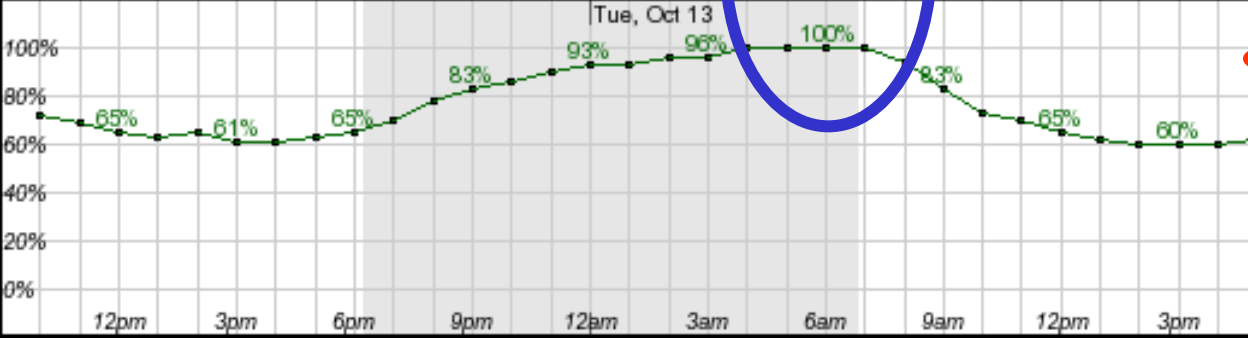
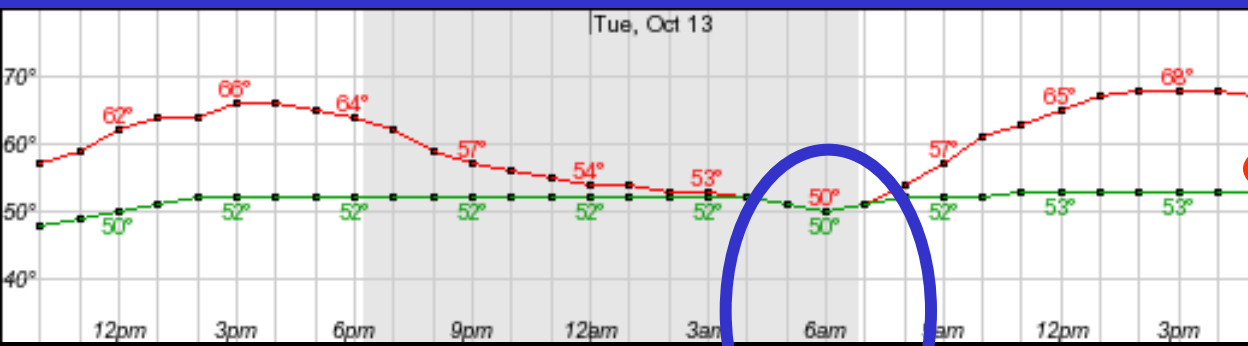
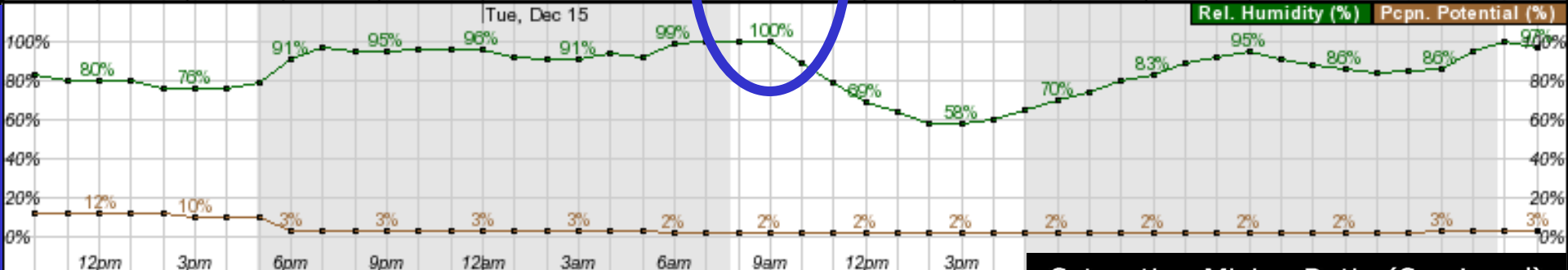
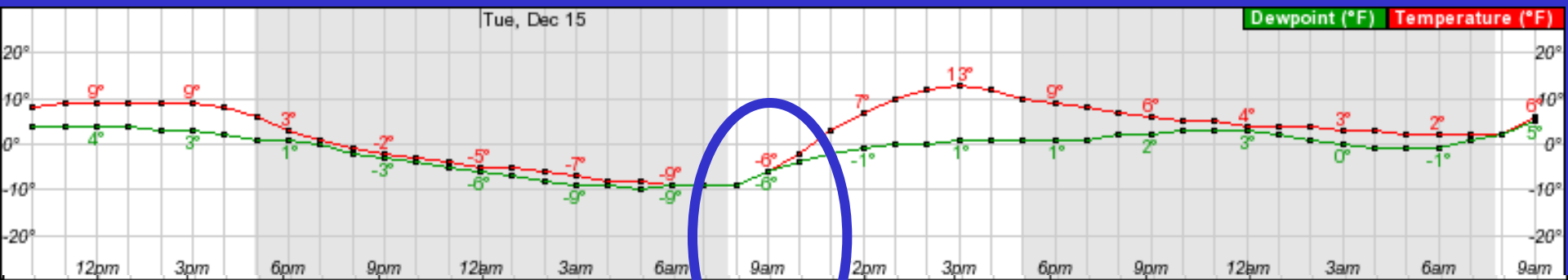
Lat: 42.94 Lon: -78.73 Elev: 712

Last Update on Jan 4, 5:54 pm EST

Light Snow
Fog/Mist

30 °F
(-1 °C)

Humidity:	92 %
Wind Speed:	W 14 G 22 MPH
Barometer:	29.78" (1009.1 mb)
Dewpoint:	28 °F (-2 °C)
Wind Chill:	19 °F (-7 °C)
Visibility:	6.00 mi.



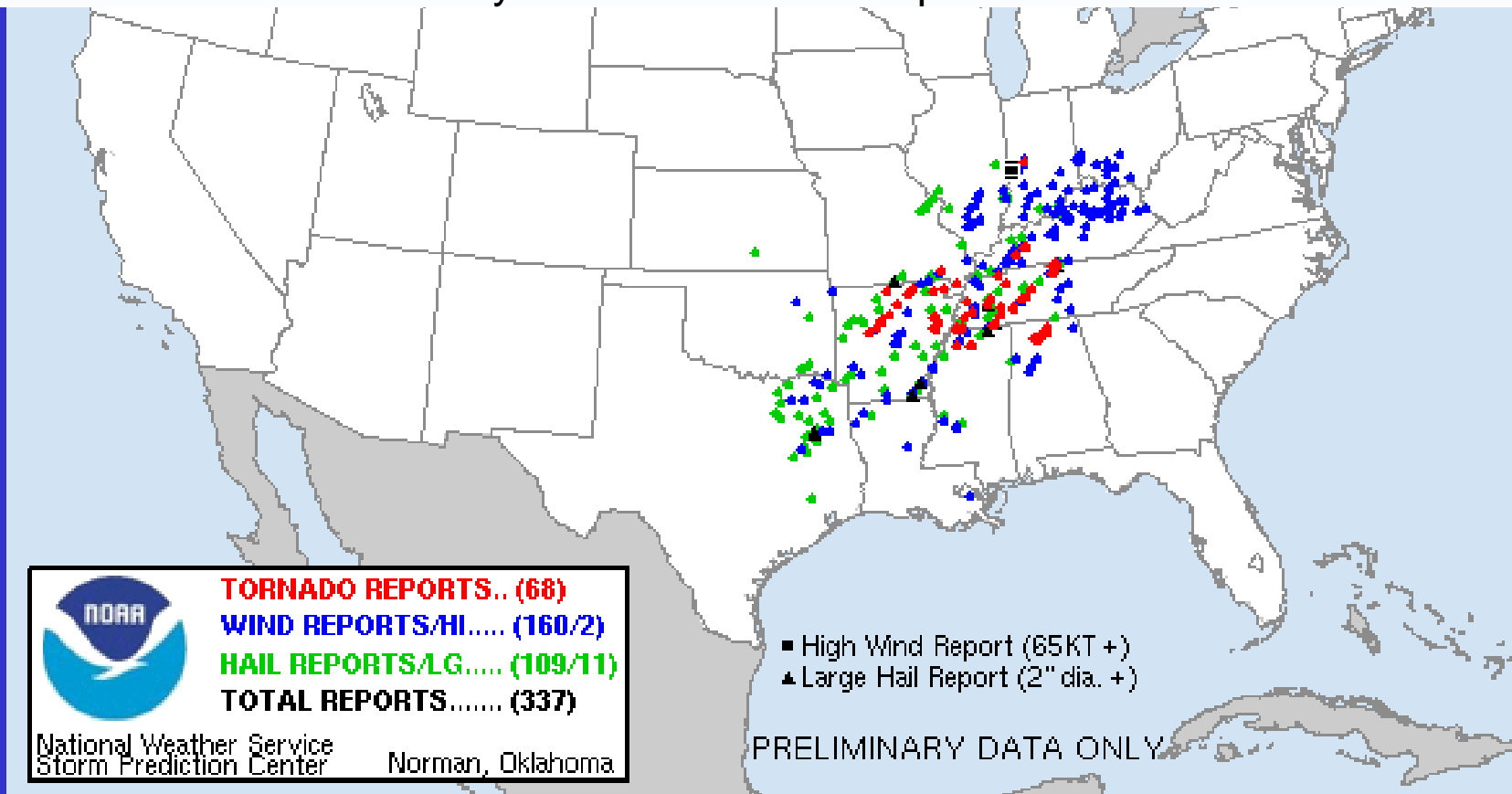
Saturation Mixing Ratio (Sea Level)

Temperature (°F)	g/kg
-40	0.1
-22	0.3
0	1
14	2
32	3.5
40	4
50	7
60	11
70	16
80	20
90	32
100	45

February 8, 2009

QUOTE

What is astonishing to me this morning are the **high dew points already soaring north into the southern Plains** and the lower Tennessee Valley. It explains why we have so many thunderstorms already this morning across Kentucky into Tennessee and parts of Iowa.

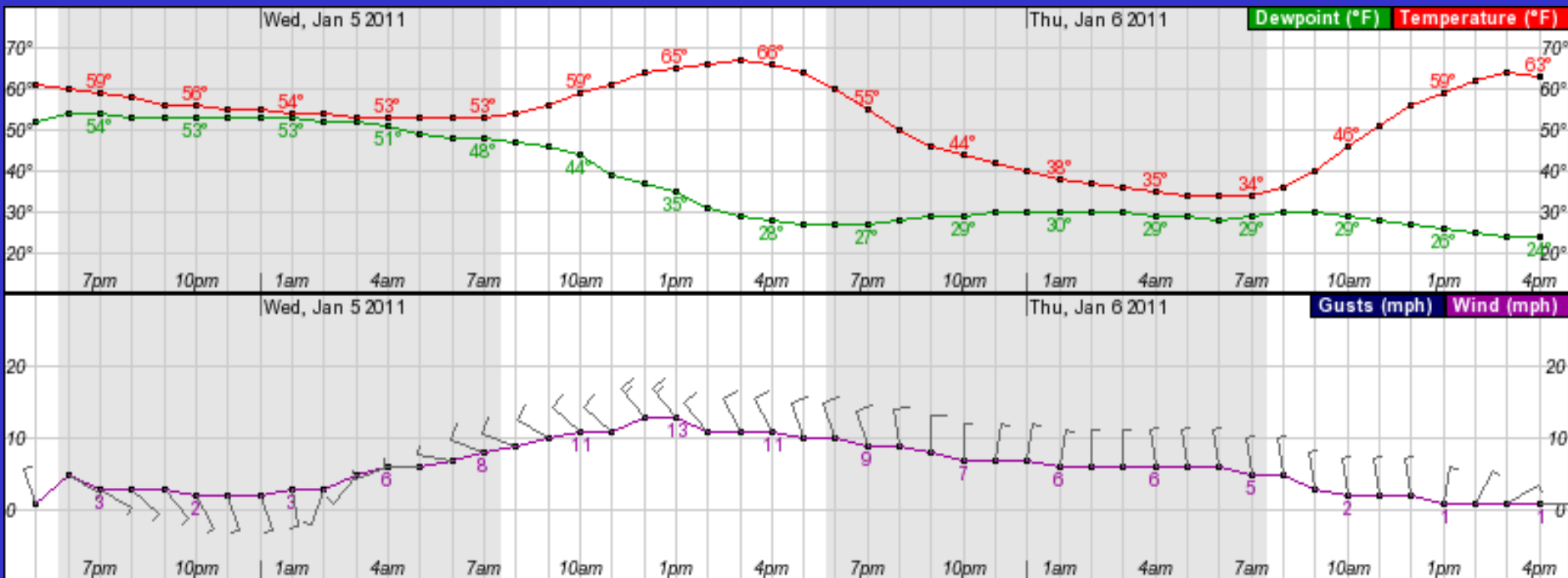


Management Decisions Based on Weather Information

You have a cold front coming through the night before a homestand

The forecast is:

- $\frac{3}{4}$ inch of rain overnight
- 35° dewpoints, sunny, breezy: **Do you pull out the tarp?**



"The weather is not just confined to temperature, precipitation and wind;

Sun angles play a big part as well.

- Do we plow snow?
- Is the sun going to melt the snow/frost?
- Do we syringe the fields?
- Do we put on the evergreen blankets?

This is just the tip of the iceberg ... it's a necessity to be on top of the weather a week ahead of time."

Troy Smith – Denver Broncos

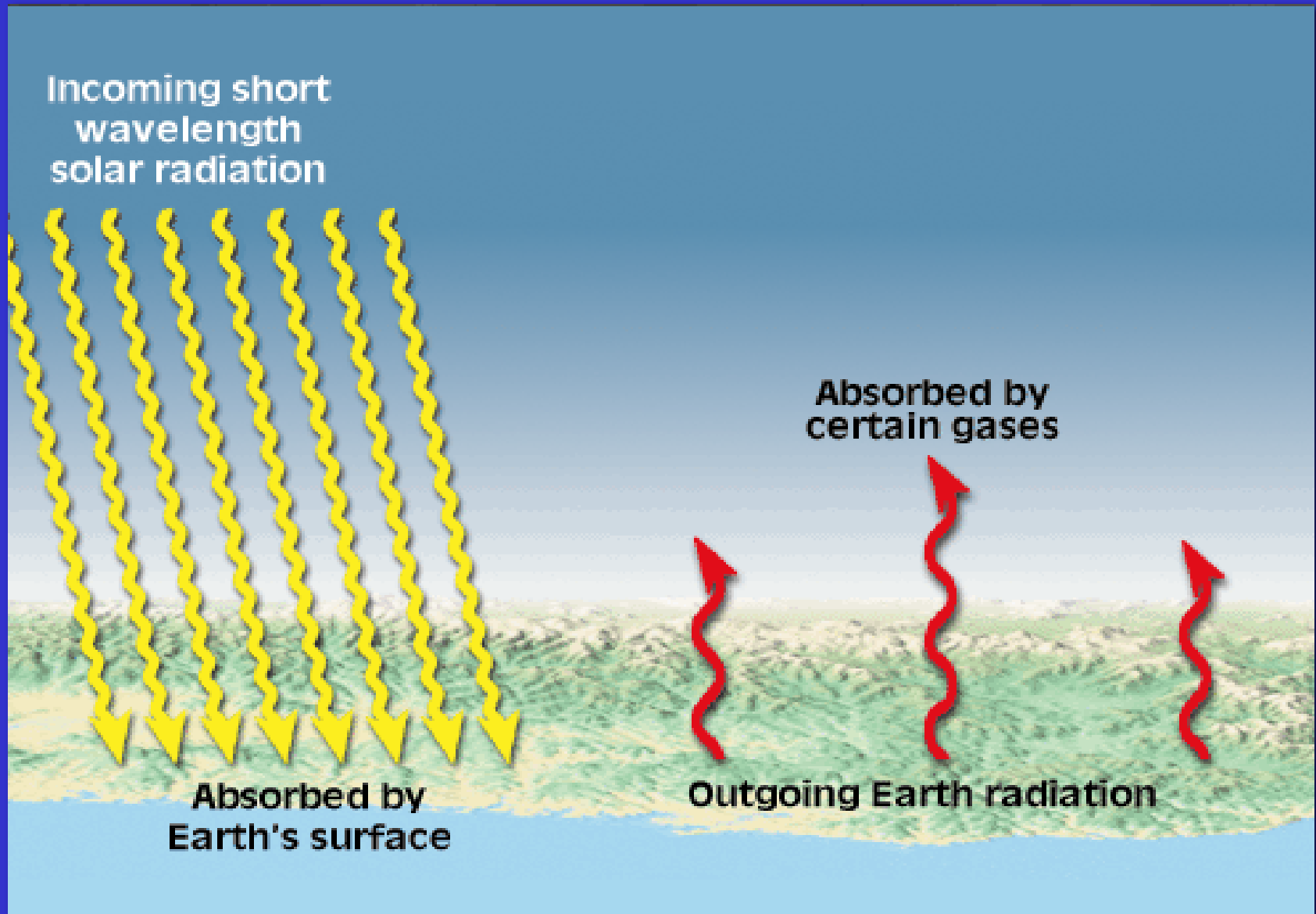
Sun Angle



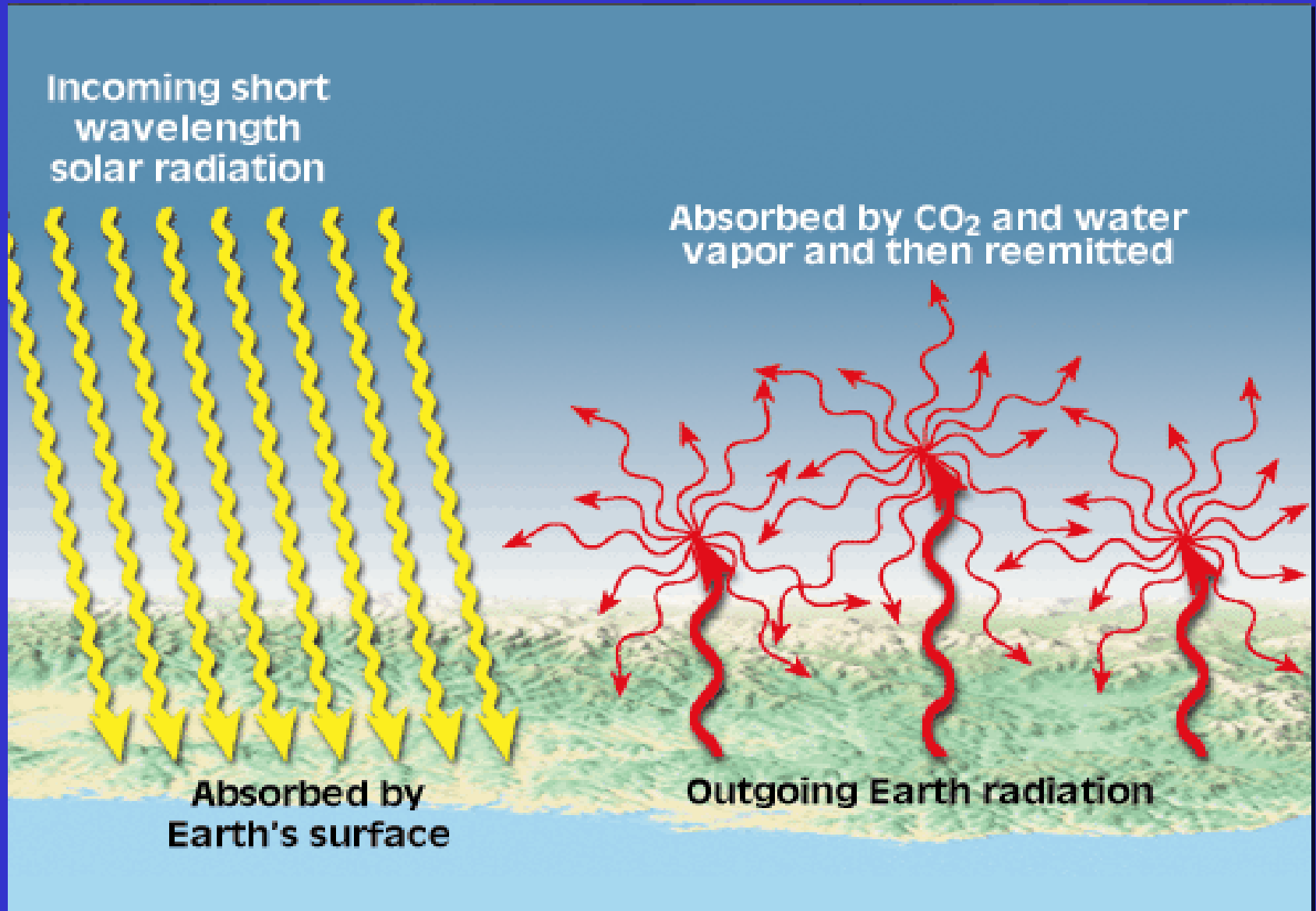
North

South

How We Experience Heat



How We Experience Heat



Why can frost occur after sunrise?

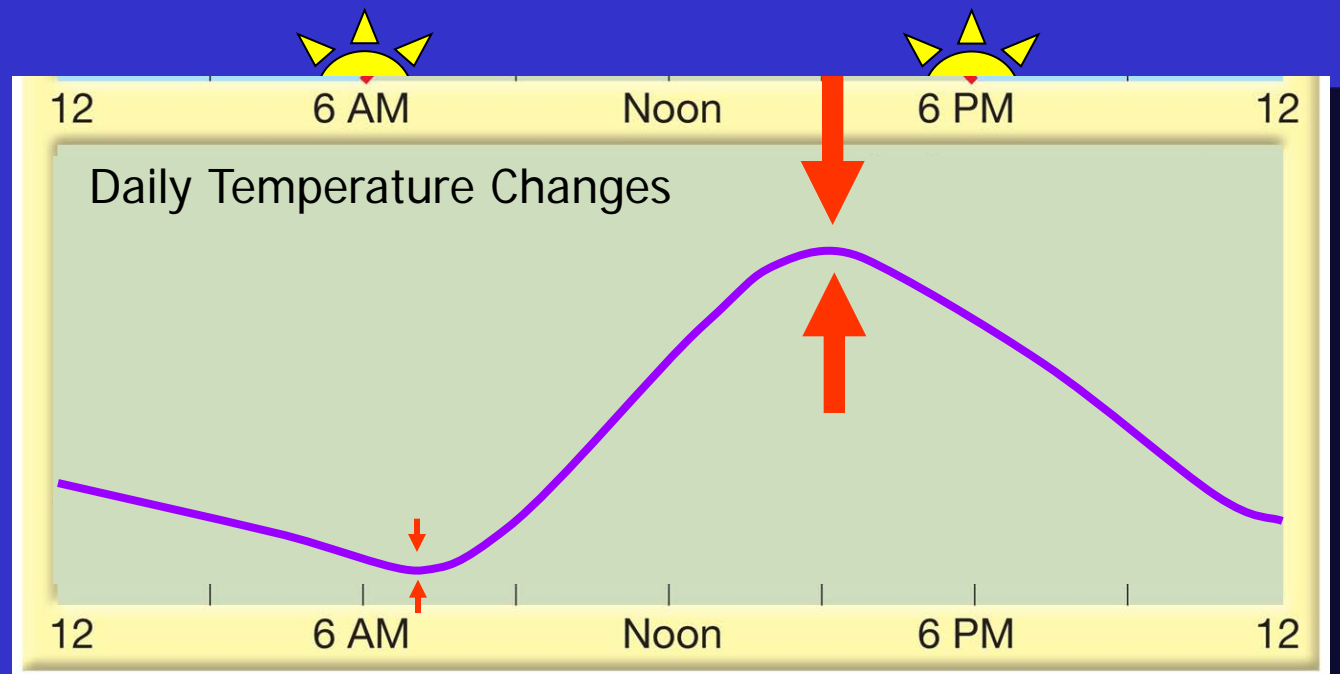
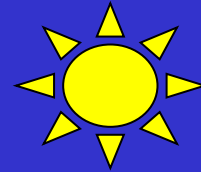
Example

Sunrise:

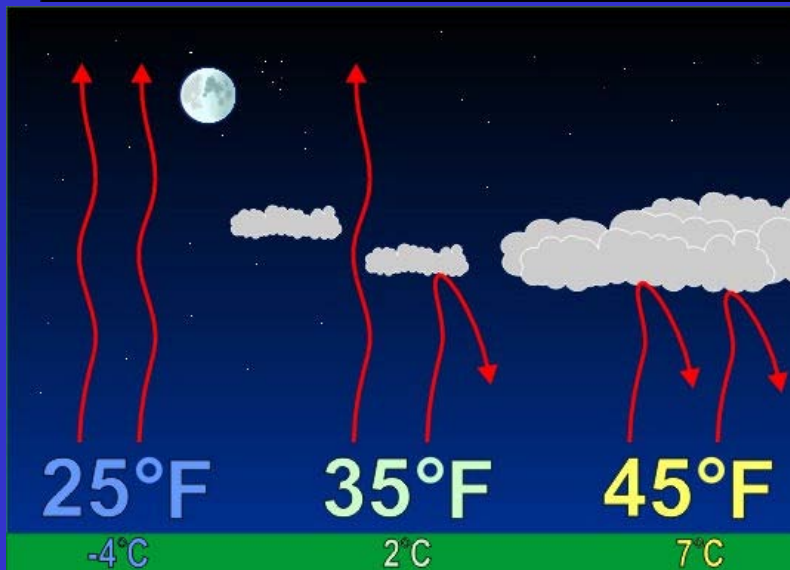
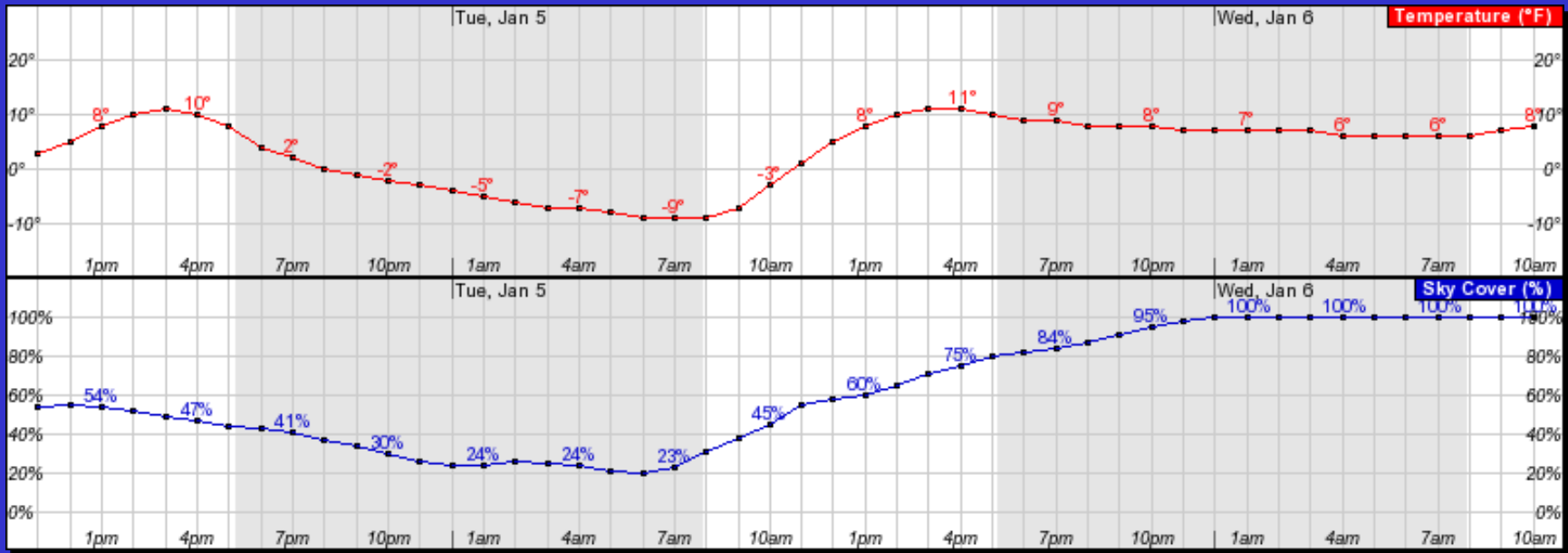
6am

Sunset:

6pm

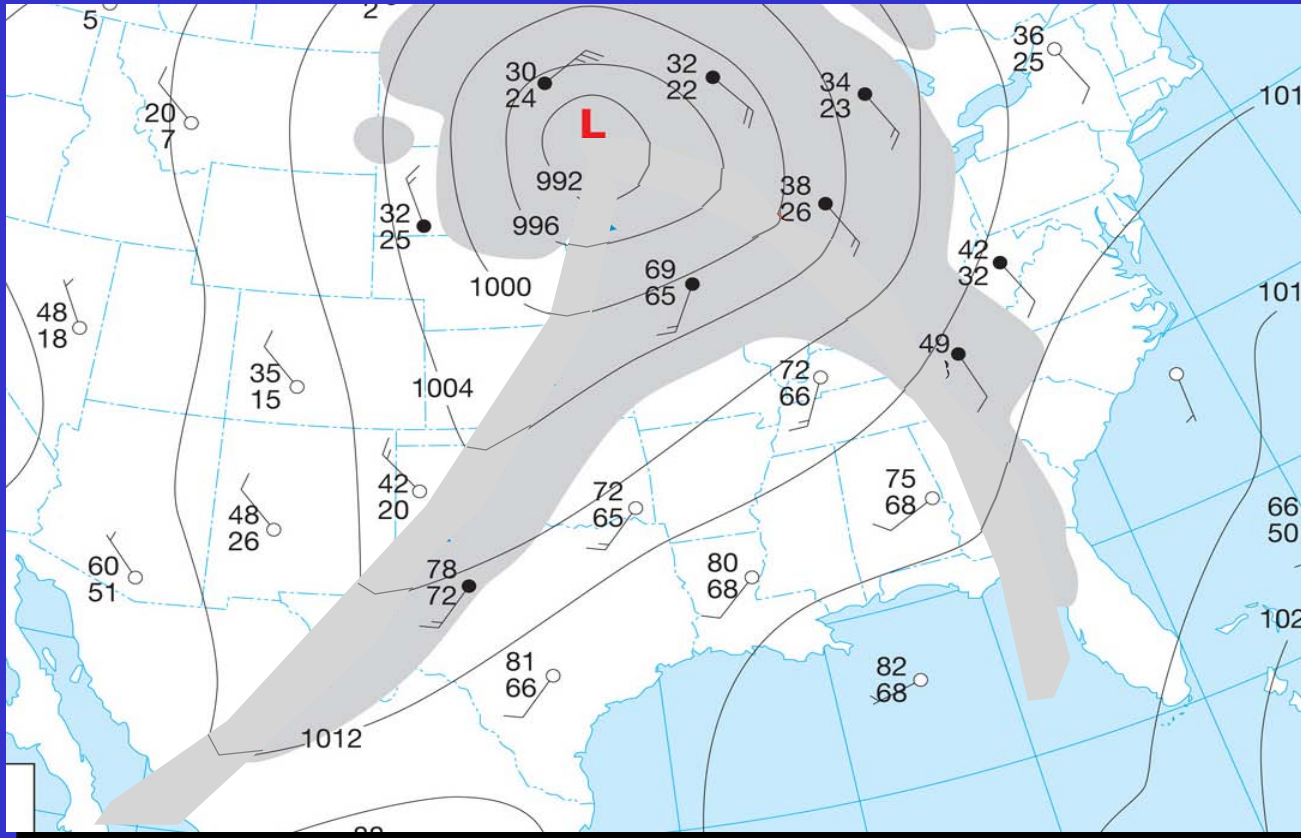


Temps vs. Cloud Cover



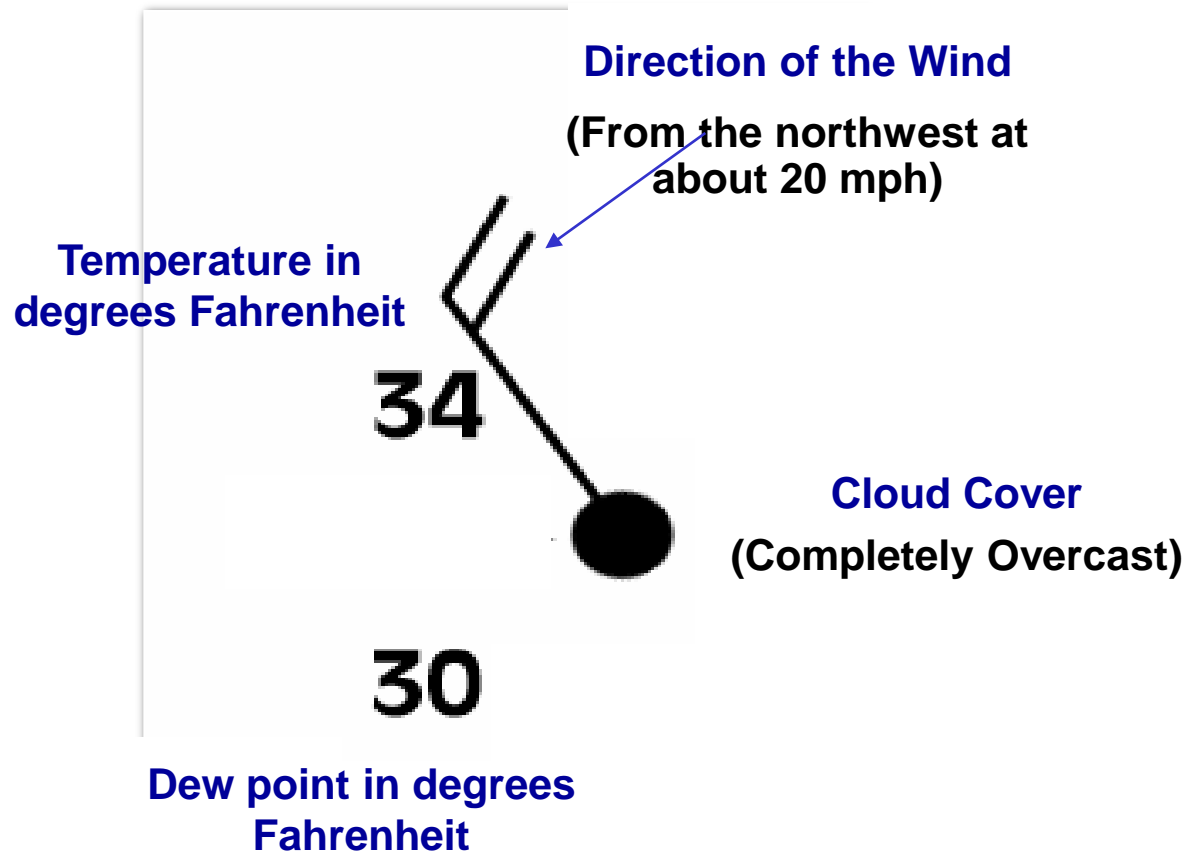
- Clouds act like an insulation blanket

Making the most of Forecast Maps



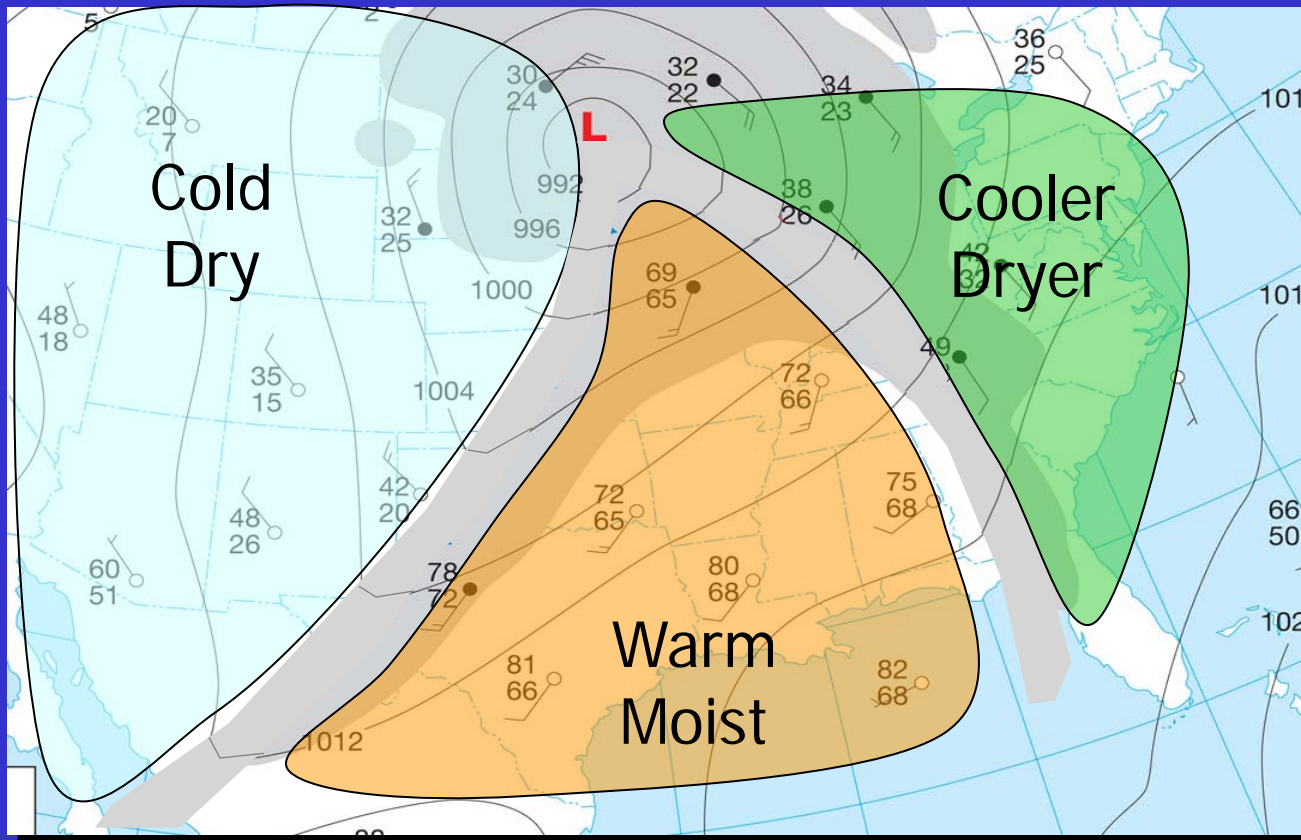
Weather Forecasting

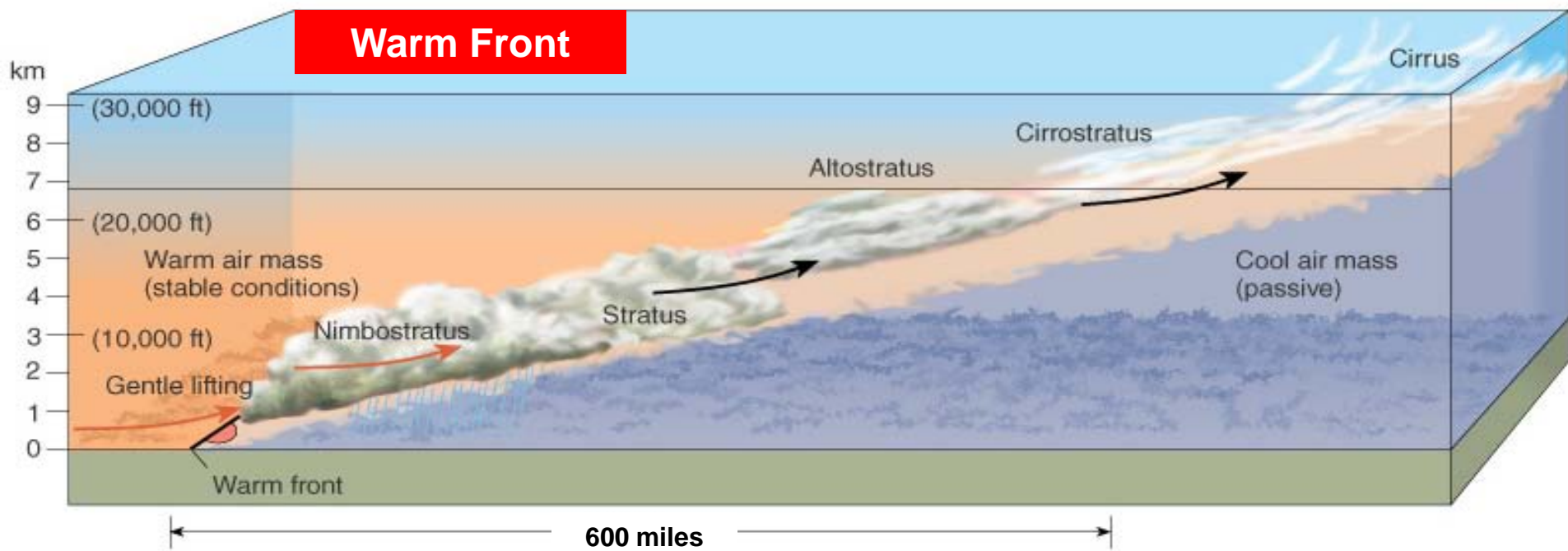
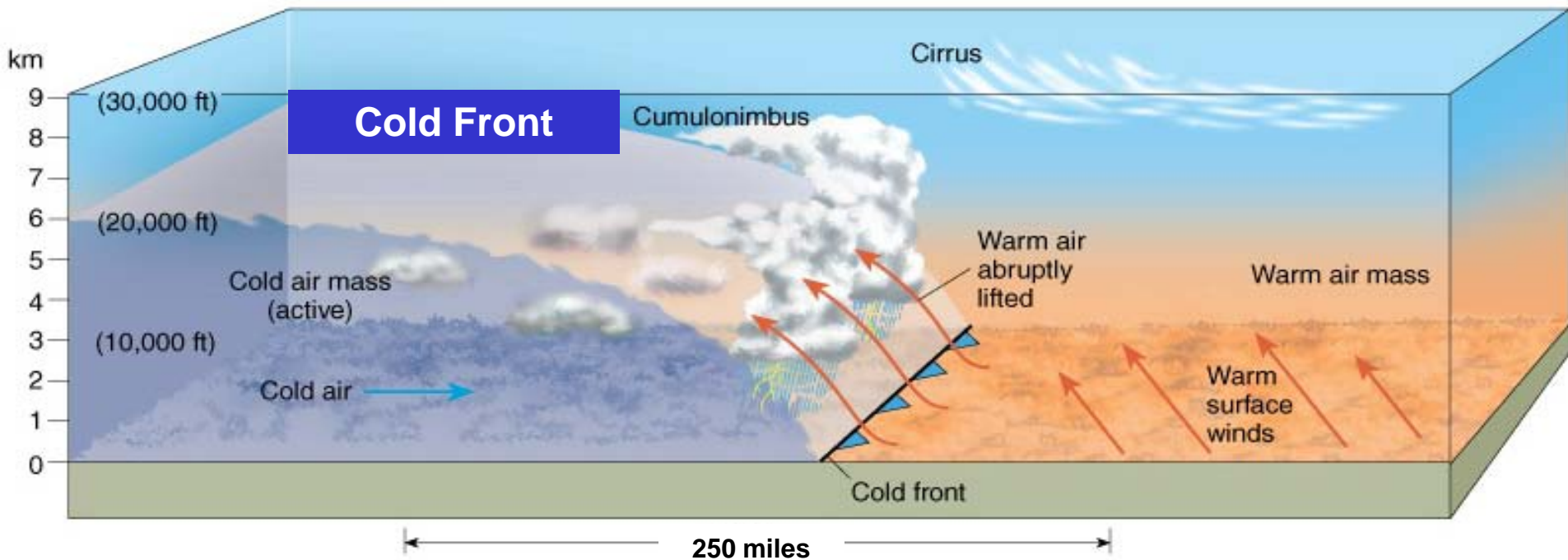
Let's review the station model



Fronts

- Narrow boundary zones separating relatively warm and cold bodies of air





Warm Front Precipitation

(~2-3 day window)



Thunderstorm Development along a Cold Front (window of hours)



Barometric Pressure

High Pressure
(descending air,
rising barometer)



Low Pressure
(rising air,
falling barometer)

Utilizing Forecasts

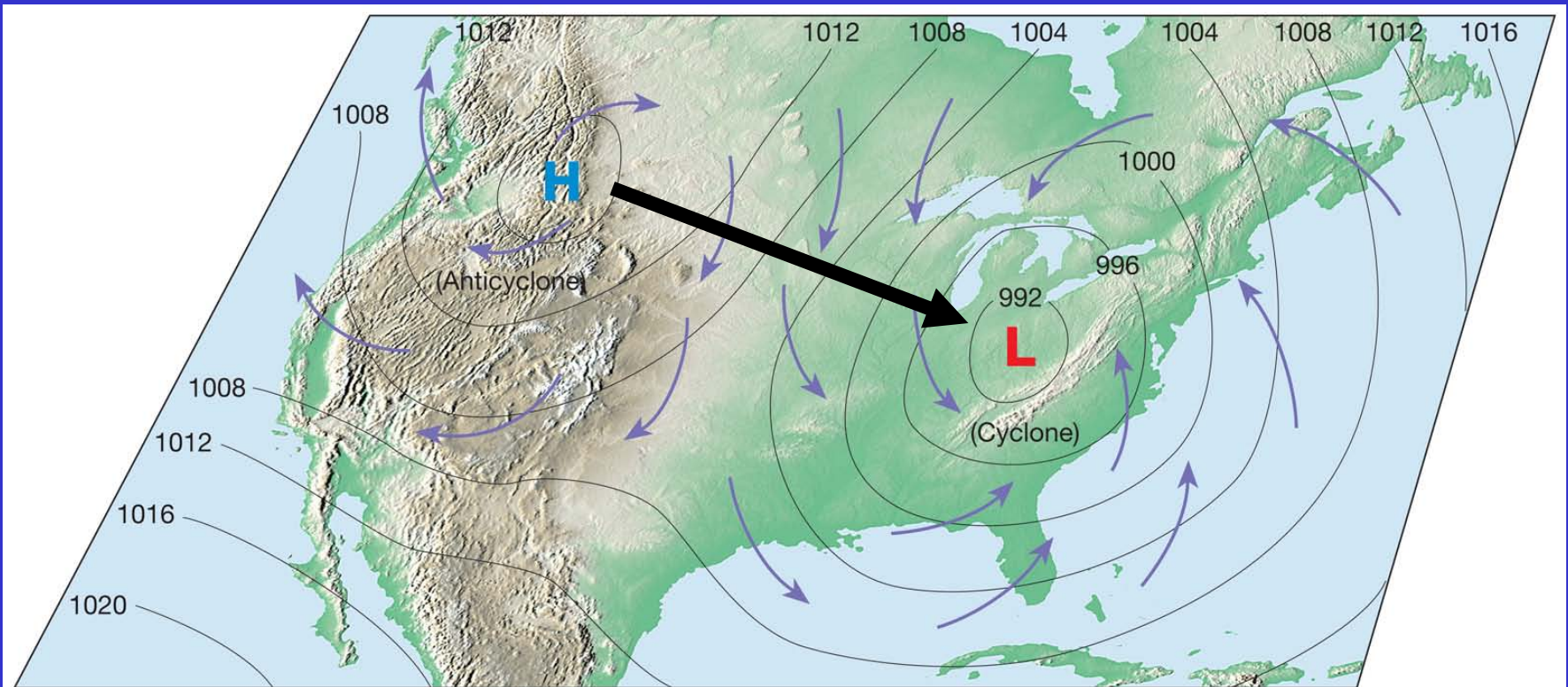
Predicting weather patterns:

Uses "rules of thumb"

- **Highs and Lows**
- **Summer: Air Mass Heating and Cooling**
- **Winter: Mid-Latitude Cyclones**

Surface High and Low Pressure Systems

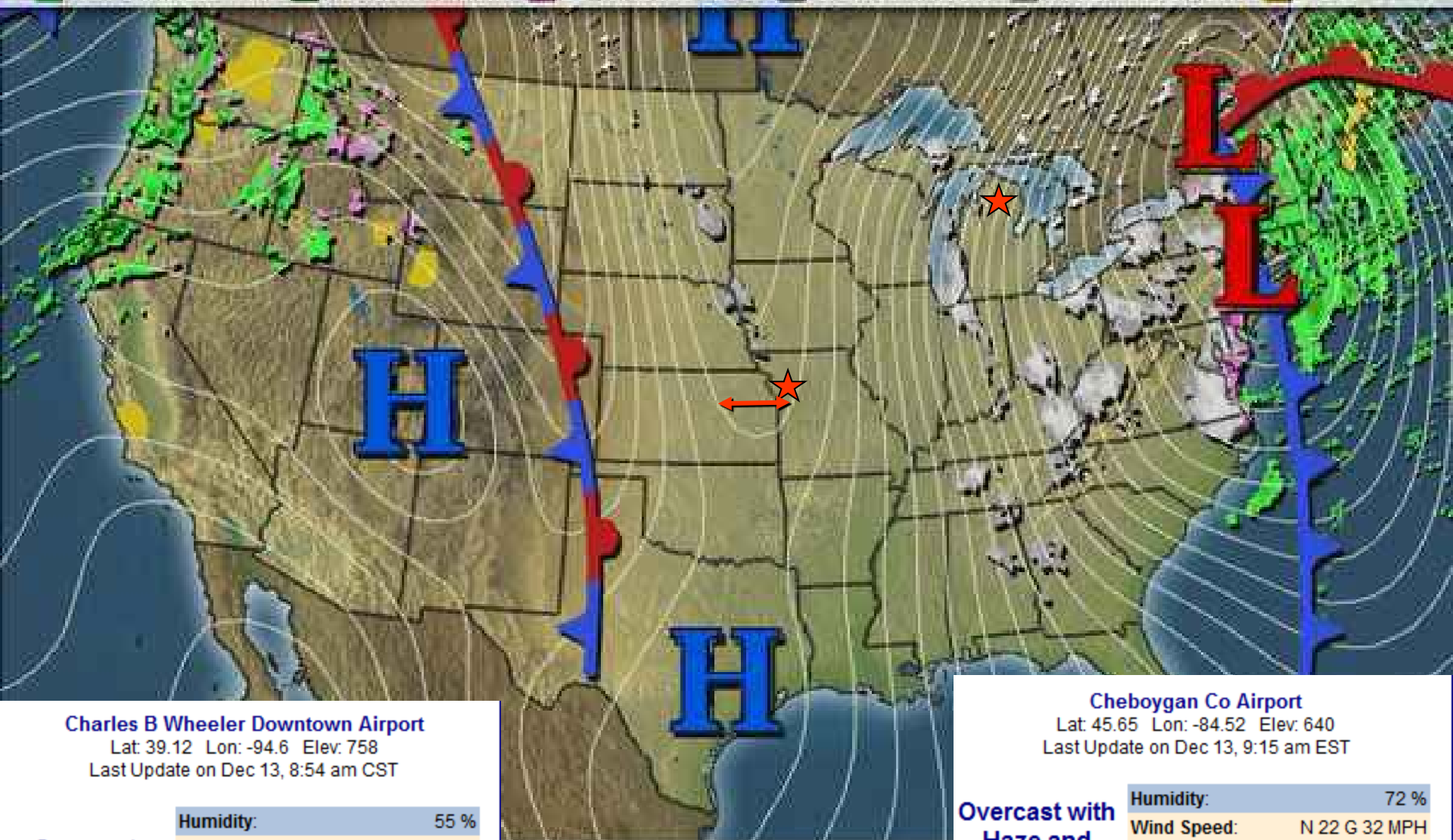
Cause of Wind Flow – **What is Wind?**



Copyright © 2007 Pearson Prentice Hall, Inc.

Current Surface

LT RAIN/DRIZZLE MOD/HVY RAIN RAIN/ICE/SNOW LT SNOW/FLUR MOD/HVY SNOW FOG



Charles B Wheeler Downtown Airport
Lat 39.12 Lon: -94.6 Elev: 758
Last Update on Dec 13, 8:54 am CST

Overcast

8 °F
(-13 °C)

Humidity:	55 %
Wind Speed:	Calm
Barometer:	30.35" (1029.3 mb)
Dewpoint:	-5 °F (-21 °C)
Visibility:	10.00 mi.
More Local Wx:	3 Day History:

Cheboygan Co Airport
Lat 45.65 Lon: -84.52 Elev: 640
Last Update on Dec 13, 9:15 am EST

Overcast with Haze and Breezy

7 °F
(-14 °C)

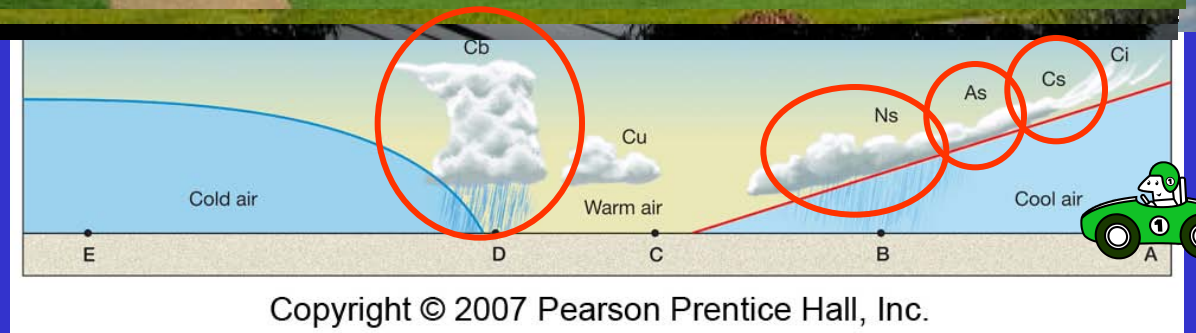
Humidity:	72 %
Wind Speed:	N 22 G 32 MPH
Barometer:	29.97"
Dewpoint:	-0 °F (-18 °C)
Wind Chill:	-14 °F (-26 °C)
Visibility:	2.50 mi.
More Local Wx:	3 Day History:

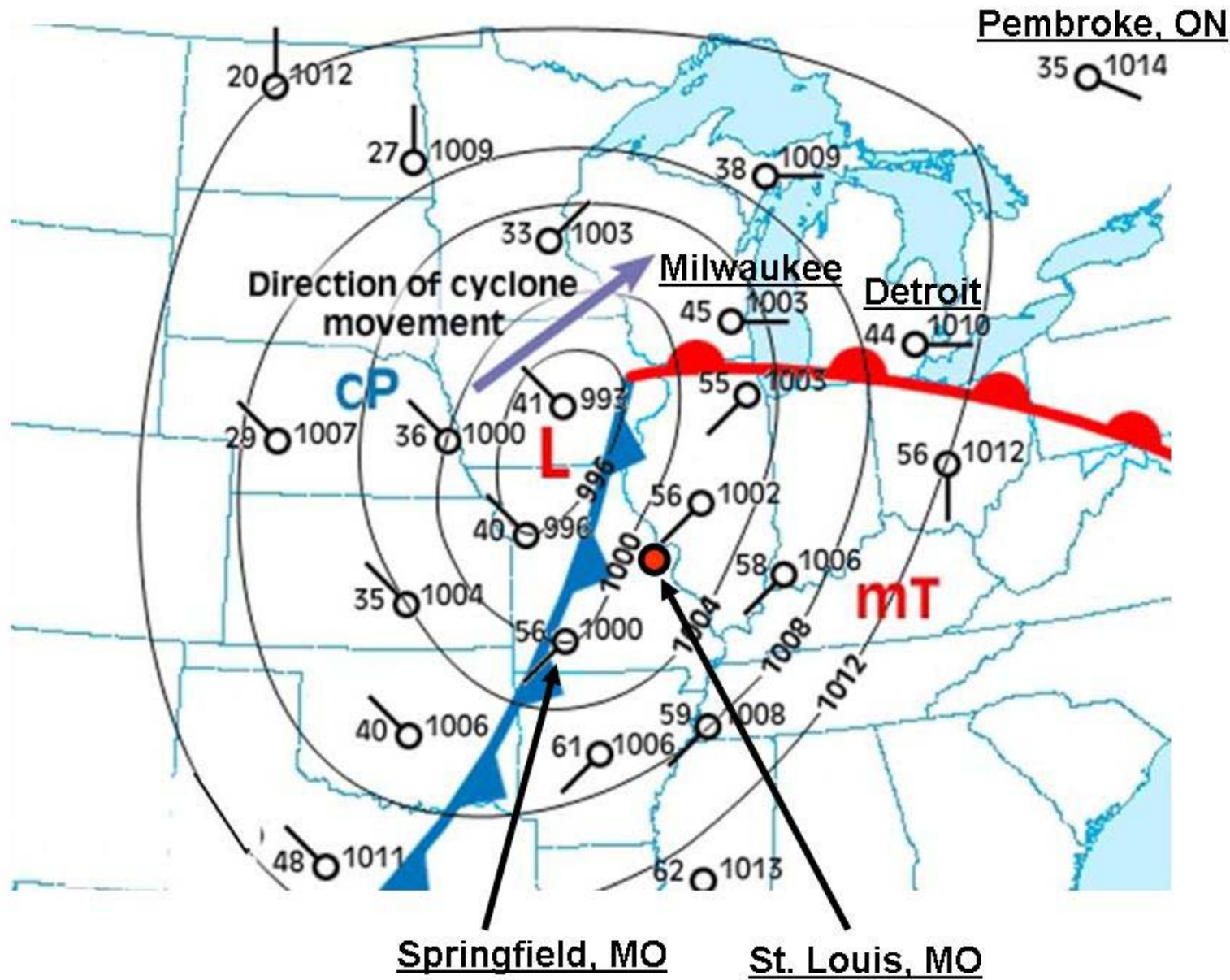
010 14:38 GMT / 13 Dec 2010 09:3

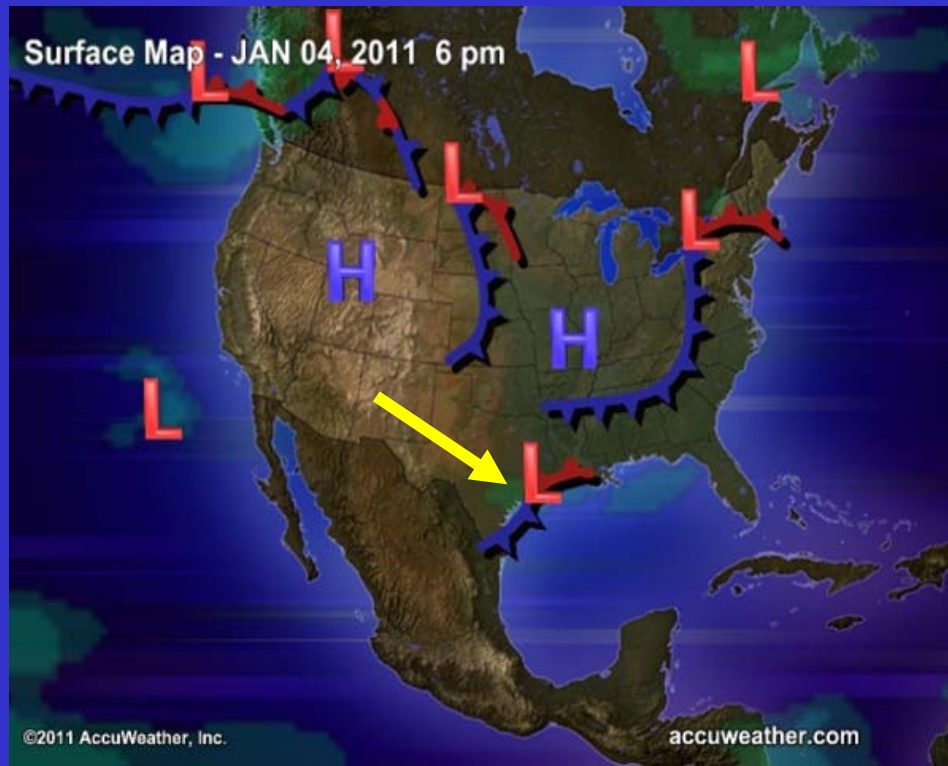
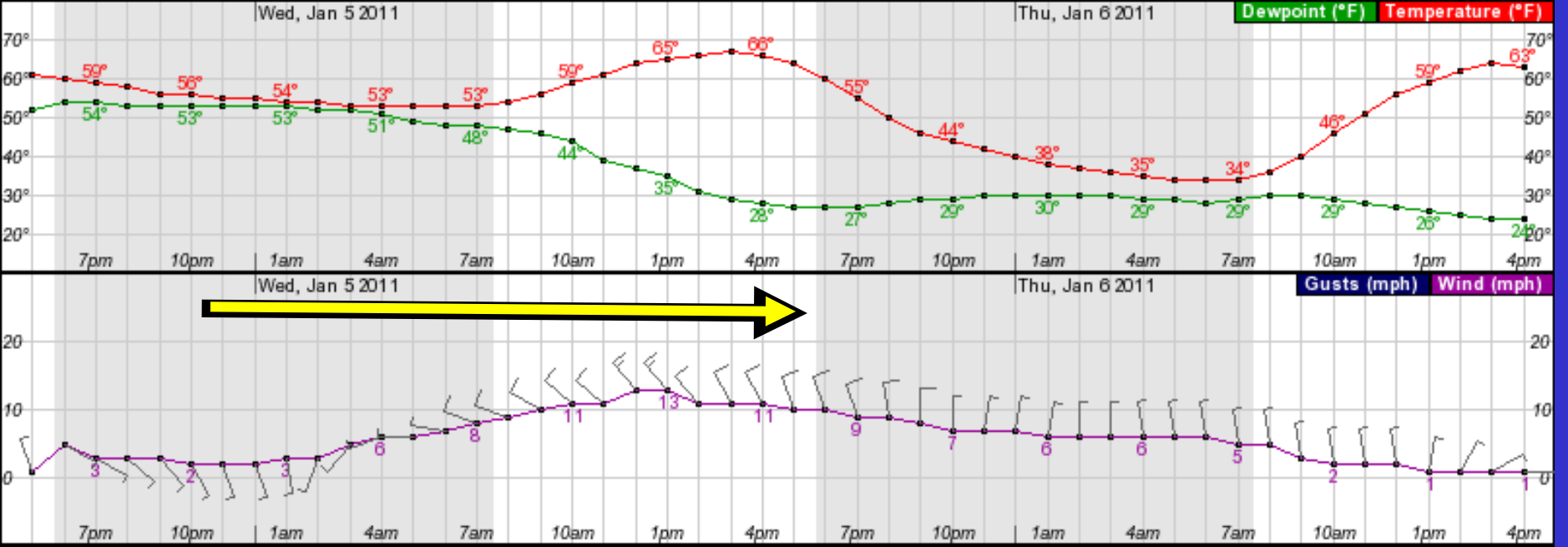
Low Pressure Centers

Have predictable patterns

- Travel West to East
- Exhibit similar weather conditions
 - Wind
 - Clouds
 - Precipitation







Getting a better handle on IPM

Planning pesticide applications

- Fungicides, weed and feeds, etc.

Calibrate sunrise, sunset, temperature and dewpoint forecasts with actual results

Brown Patch Example

Pest Management Log	
Date	7/16/10
Current Time	7:00 am
Sunrise / Sunset	5:52 / 9:32
Wind Speed / Direction	NW 5-8 mph
Current Temperature	69°F
Dewpoint	62
Relative Humidity	84%
Target Pest ID	Brown Patch – small patches
Product Used	
Total Amount	
Amount ai	

Also to be monitored ...

- The amount of sunlight expected and how much wind is blowing on a given day.
- Evapotranspiration figures are a nice guide, but I like to use my skin.
 - Am I sweating a lot or is my skin dry?
 - Do I need to apply extra sunscreen that day or is the UV level fairly low.
- This also changes based on the time of year.
 - June is vastly different from September in terms of sun strength and the amount of daylight."

Larry Divito, Minnesota Twins



Mammatus Sky – Hail may be coming

Lightning Safety





Hey!!?!!

Copyright Robert A. Prentice, 1990

Lightning can strike long distances, even outside of rain and cloud cover

- 45% of lightning casualties occurred on open fields (includes Sports Fields)

“If Thunder Roars, Get Indoors”

- Obey the 30/30 rule
 - If thunder occurs 30 seconds or less after lightning strike
 - Wait 30 minutes after the last thunder



If You Can Hear Thunder, Seek Shelter!

- **Avoid Wide Open Areas**
 - **Sports Fields**
 - **Playgrounds**
 - **Parking Lots**
 - **Beaches**
 - **Others**





Not Safe!!

Keep Away From Trees!

Not Safe!!



Not Safe!!



Not Safe!!



Safe!!



Not Safe!!



Safe (r)!!



Safe
Just don't touch the sides!!



Weather Resources

Free Websites

Current weather:

www.weather.gov

www.wunderground.com

www.weather.com

www.accuweather.com

Professional Weather

Customized Online Ad

Online Consulting,

DTN Meteorlogix www.dtn.com

Custom Weather www.customweather.com

Many, many more...

History for KMOSTLOU11

Shaw/Tower Grove, St. Louis, MO — [Current Conditions](#)

Yearly Summary for 2010

[« Previous Year](#)

April

5

2010

View

[Next Year »](#)

[Daily](#)

[Weekly](#)

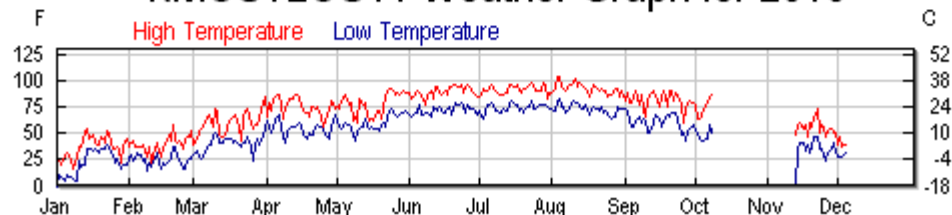
[Monthly](#)

Yearly

[Custom](#)

	High:	Low:	Average:
Temperature:	104.9 °F	0.0 °F	56.0 °F
Dew Point:	81.4 °F	-5.5 °F	45.5 °F
Humidity:	100.0%	21.0%	70.7%
Wind Speed:	12.0mph from the SW	-	0.2mph
Wind Gust:	21.0mph from the ENE	-	-
Wind:	-	-	South
Pressure:	30.17in	24.00in	-
Precipitation:	34.24in		

KMOSTLOU11 Weather Graph for 2010



A photograph of a city skyline at sunset. The sky is a mix of orange, red, and dark blue. In the foreground, there is a dark wooden railing. To the left, a large brick building with many lit windows is visible. In the center and right, several skyscrapers are silhouetted against the sunset. One prominent skyscraper has a distinctive top. A tall stadium light pole is visible on the right side.

Questions?

Thank You!